

REMARKS

Status

Claims 1-20 were originally filed, and were at issue in this Office Action. By the present amendment, claims 2-4, 10, 11 and 15-20 have been canceled; and new claims 21 and 22 have been added.

Accordingly, it is claims 1, 5-9, 12-14, 21 and 22 which are presently at issue.

The Rejection

In the Office Action mailed December 15, 2005, all claims were rejected. Claims 1, 2, 5, 8, 9, 10, 12 and 15-19 were rejected under 35 U.S.C. §102 as being anticipated by U.S. Patent 6,482,476 of Liu. Claim 15 was rejected under 35 U.S.C. §102 as being anticipated by U.S. Patent 5,582,414 of Miyazaki. Claims 1-5, 8-12 and 15-19 were rejected under 35 U.S.C. §102 as being anticipated by U.S. Patent 6,213,075 of Ajayi.

Claims 1, 2, 5, 8-10, 12 and 15 were rejected under 35 U.S.C. §102 as being anticipated by Japanese Published Application 08028346 of Maejima.

Claims 6, 7, 13, 14 and 16-20 were rejected under 35 U.S.C. §103 as being unpatentable over U.S. Patent 5,582,414 of Miyazaki in view of U.S. Patent 6,213,075 of Ajayi.

In addition, claim 9 was objected to under 35 U.S.C. §112, second paragraph.

Applicant thanks the Examiner for the search, the Office Action, and for the thorough explanation of the basis of the rejections.

The Presently Claimed Invention

Applicant will briefly recapitulate the principles of the invention as now set forth in the amended claims. The present invention is directed to a piston pin for an internal combustion engine, which piston pin has a vapor deposited coating of chromium nitride (including doped

chromium nitride) thereupon. As detailed in the specification, this coating combines high hardness and wearability with high lubricity. As such, the coating greatly prolongs the service life of the piston pin and increases the efficiency of an engine which incorporates the pin. As further detailed in the application, this combination of hardness and lubricity is unusual and particularly advantageous when applied to piston pins. Piston pins are subjected to high mechanical loadings, high pressure and high temperature and benefit greatly from lubrication; however, it is very difficult to obtain direct access to piston pins to renew or replace lubricant coatings thereupon. The coatings of the present invention may be applied by vapor deposition technology which is rapid and low cost, and provides a highly adherent coating.

All claims are now limited to a piston pin having a chromium nitride coating thereupon. As will be discussed hereinbelow, none of the prior art shows or suggests including a chromium nitride coating onto piston pins, and the claims as presently amended are all allowable.

The Rejections under 35 U.S.C. §102

The claims, as presently amended, avoid all of the rejections made under 35 U.S.C. §102.

The 6,482,476 patent of Liu shows a low temperature plasma chemical vapor deposition process as used for depositing coatings of titanium nitride onto articles which comprise fuel injector components, hydraulic valve components and the like. There is no teaching whatsoever in the '476 patent of the deposition of chromium nitride coatings onto any type of substrate, much less a piston pin of an internal combustion engine. Furthermore, there is no teaching which would suggest modifying the process of the '476 patent to deposit chromium nitride coatings, and there is no teaching or suggestion leading one to appreciate the particular value of chromium nitride coatings on piston pins. Therefore, the '476 patent does not show or suggest the presently claimed invention.

U.S. Patent 5,582,414 of Miyazaki was cited under 35 U.S.C. §102 against claim 15 only. By the present amendment, claim 15 has been canceled; therefore, this rejection is moot.

U.S. Patent 6,213,075 of Ajayi shows the chemical vapor deposition of chromium nitride onto an axle pin of a roller follower in an internal combustion engine. The axle pin is different in form and function from the piston pin of the present invention. In that regard, the axle pin is not subjected to loadings, forces, temperatures and other operating conditions encountered by piston pins. As such, the teaching of Ajayi is to an invention significantly different from that presently claimed. Furthermore, there is no teaching or suggestion in Ajayi which would lead one of skill in the art to recognize that chromium nitride coatings could be used on piston pins so as to achieve the benefits of the present invention. Therefore, the Ajayi patent does not show or suggest the principles of the present invention.

Another group of rejections were made under 35 U.S.C. §102 on the basis of Japanese Application JP 08028346 of Maejima. Maejima shows a piston boss having a composite coating thereupon. The coating is prepared by first forming a porous oxide layer on the piston component by an electrolytic process, and thereafter impregnating a relatively soft lubricant such as molybdenum sulfide or a fluororesin into the porous oxide. Clearly, both the coating process and the resultant layer are not encompassed or suggested by the presently pending claims. The sole teaching of Maejima is to an electrolytically prepared, composite coating of oxide and soft lubricant, and not to a vapor deposited chromium nitride coating. Therefore, Maejima does not show the presently claimed invention, and actually leads one of skill in the art away from the principles thereof.

The Amended Claims Overcome the Rejections under 35 U.S.C. §103

Claims 6, 7, 13, 14 and 16-20 were rejected under 35 U.S.C. §103 as being unpatentable over Miyazaki in view of Ajayi. Miyazaki was cited for its teaching of a piston ring having a multilayered coating thereupon, and it was the Examiner's opinion that in view thereof, it would be obvious to substitute a multilayered coating into the invention of Ajayi so as to approximate the subject matter of the rejected claims. Applicant respectfully submits that in view of the general inapplicability of Ajayi, as detailed above, this rejection is inappropriate. As detailed above, Ajayi does not show or suggest that chromium nitride coatings may be utilized in connection with piston pins, and there is no teaching in the prior art taken as a whole which would suggest so utilizing chromium nitride coatings in accord with the presently claimed invention. In view thereof, Applicant respectfully submits that this rejection is now overcome.

The Rejection under 35 U.S.C. §112

Claim 9 was rejected under 35 U.S.C. §112, second paragraph, on the grounds that the language "one of said piston pin" did not have a proper antecedent basis. In accord with the Examiner's suggestion, Applicant has herewith deleted "one of" from the claim, and this rejection is overcome.

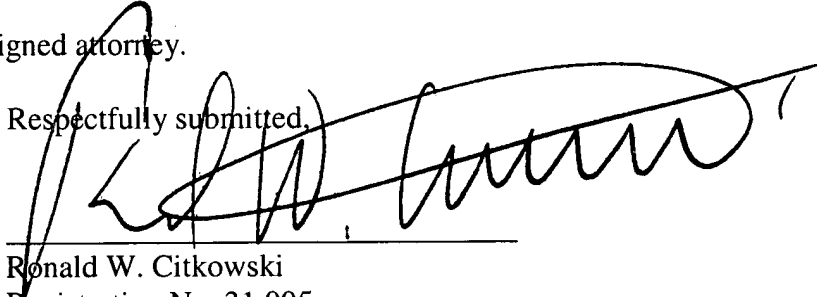
Conclusion

By the present amendment, Applicant has restricted all claims to piston pins coated with a chromium nitride coating via a vapor deposition process. The only teaching in the prior art of a piston pin is the Maejima Japanese publication, and this reference teaches away from the principles of the present invention since it shows a composite, lubricious coating comprised of a porous oxide layer having a relative soft lubricant impregnated therein. While chromium nitride coatings are known in the prior art, the prior art nowhere shows or suggests that such coatings

could be advantageously applied to piston pins in accord with the presently pending claims. Therefore, the prior art does not show, and actually teaches away from, the presently claimed invention.

In view of the amendments and remarks presented herein, Applicant respectfully submits that all rejections are overcome, and the application is in condition for allowance. Any questions, comments or suggestions which would place the application in still better condition for allowance should be directed to the undersigned attorney.

Respectfully submitted,



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